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ABSTRACT

This paper argues that recent developments in technology hold considerable promise for distance education. Audiocassettes, audiographics (the combining of natural sound, via the telephone or audiocassettes, with computer-generated graphics), videocassettes, and computer conferencing are used as examples to identify factors that should be considered in media selection, including access, costs, student control, teacher control, organization, teacher time, and teaching objectives. The use of the CYCLOPS audiographics system in distance tutorials of the Open University is highlighted. Difficulties in introducing these newer technologies into existing distance education systems are also discussed. Reasons for using the newer media in distance education are offered, including their potential for improving access to and providing variety in learning materials, their instructional strength, and their cost effectiveness. Twelve references are listed. (LMM)

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SELECTING AND DESIGNING

LOW-COST MEDIA

FOR

DISTANCE EDUCATION

Paper presented at:
Zentrales Institut für Fernstudienforschung,
Fernuniversität,
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ABSTRACT

Selecting and Designing Low-Cost Audio-Visual Media for Distance Education

- A.W.Bates -

Open University

This paper agrues that recent developments in technology hold considerable promise for distance education. Four examples are chosen: audio-cassettes, audio-graphics, video-cassettes and computer-conferencing. These are used to identify the factors that need to be taken into consideration when choosing media. The difficulties that still exist regarding the introduction of these newer technologies into existing distance education systems are also discussed.

MEDIA IN EDUCATION

In the beginning was the teacher. From Socrates onwards, for nearly 2000 years, person-to-person contact was the main medium of teaching. The invention of the Gutenberg press 500 years ago did not displace the teacher as the main medium of teaching, but it did revolutionise education, as it did many other areas of social life. After the book, education became institutionalised, because of the need to develop skills of literacy and other associated "life-skills" (see, Postman,1983, for a full discussion of this development). Broadcasting was the next major medium of importance for education, with the development of schools radio 60 years ago, and then television, barely 30 years old regarding education. The development of media for educational use can be seen then as a slow but accelerating process, but in no case replacing person-to-person contact as the primary source of education.

But look at the last five to ten years. There has been an explosion in the range of media suddenly available to the educator:

Print
Terrestrial broadcasting (television and radio)
Cable TV
Satellite TV
Audio-cassettes
Video-cassettes
Telephone teaching
Mainframe computers
Microcomputers
Viewdata and teletext
Video-discs

And underneath this heap of technology: the poor teacher!

Similarly, distance education has had a more recent but equally relatively stable historical development, with print and written communication being the main media of teaching in most institutions, supplemented with person-to-person (direct) contact. And this media explosion in the last few years has even more significance for distance education. The range of options has suddenly widened, and consequently so has the difficulty in decision-making. Perhaps even more difficult to understand, but much more significant, is the likely impact of these new technologies on the whole

organisation and structure of distance education. Peters(1971) noted that distance education institutions such as the British Open University and Fernuniversität represent an industrialised form of instruction; however, the communications revolution is leading us into the post-industrial era, and the implications of this will be just as great for distance education as for other aspects of our lives.

WHY USE MEDIA?

So far, the major, established distance teaching institutions have at best seen the newer media as interesting, if peripheral, developments that can be grafted on to existing structures; at worst, they have ignored them. Both these approaches I believe to be mistaken. In order though to make sensible decisions about the selection and use of the newer media, we have to answer first the fundamental question: why use media at all?

There are two reasons why media get used in education, one good and one bad. The bad reason is the technological imperative: because the technology is there, it must be used. The good reason is that some of the newer technologies are stronger instructionally than more "traditional" teaching media (and I would include teachers or person-to-person contact as a medium).

I see several reasons for using the newer media in distance education:

1. to deliver materials more effectively to students (access);

2. to provide variety in learning materials: there is a good deal of evidence from our research at the Open University that students vary a great deal in their preferred learning styles and choice of preferred media, and that alternative approaches through different media increase the chances of more students understanding or reaching deeper levels of comprehension;

3. some of the newer media are stronger instructionally (a point I shall elaborate on throughout this paper);

4. some of the newer media are more cost-effective than previously used media;

5. some of the newer media are now getting very easy to use, making the design of distance teaching materials less difficult and time-consuming.

In relation to the third point, I believe that some of the newer media are more effective educationally because they give the distant learner more control over his or her learning materials, they make them more active as learners, they provide learners with better forms of feedback, and make learning more individualised.

These then are the claims I make for some of the newer media. I now propose to select four of the newer, low-cost media and examine them in more detail. I will then examine what the characteristics are of such media, to enable a more generalised approach to media selection to be developed.

The four low-cost media I will discuss are:

- audio-cassettes
- audio-graphics systems
- video-cassettes
- computer conferencing

These are not the only low-cost media I could have chosen, -telephone teaching in particular has already been used extensively in distance education - but these four media should be sufficient to make the point.

AUDIO-CASSETTES

The most important development in media at the British Open University since its inception has not been computer-assisted learning, video-discs, viewdata or satellite TV, but the humble audio-cassette. In 1978, virtually no courses used audio-cassettes; by 1983, the Open University was sending 500,000 sixty-minute cassettes to students. Why this sudden popularity, not just with course teams, but also with students, who on some courses have rated the cassettes more valuable even than the print material?

Well, firstly, the academics on the course teams found that audio-cassettes, when integrated with the correspondence texts, could cover a wide range

of teaching functions (see Bates, 1984a, for a full list). Primarily, though, audio-cassettes are used for two main purposes. The first is to talk students through a range of other materials: mathematical formulae, statistical tables, maps, rock samples, colour film-strip, textual analysis, or even analysis of television material. The second major role is to bring raw material to the students for them to analyse, consider and interpret: conversations, classroom interaction, music, etc. Note that audio-cassettes are rarely used as straight lectures. Furthermore, they are not produced for continuous listening; instead, students are actively engaged in reading, stopping the tape to do activities or just to think before answering.

A second, perhaps the most important, reason for their success is that academic members of the course team find it easy to design audio-cassette material integrated with the other teaching materials. They can take a tape-recorder home, and rough out the script for the audio-cassette as they develop the correspondence text. While at the Open University the final master tape is always professionally recorded, the academic has already developed the script before he gets to the studio.

Thirdly, audio-cassettes are extremely cheap to distribute. A C60, containing one hour of recorded material, and often requiring at least three hours' study time, can be copied, cassetted and mailed to a student for 50 pence. The student keeps the cassette, as it would cost more to collect. Furthermore, 94% of Open University students have audio-cassette machines at home.

Lastly, they are very popular with students. Durbridge, who has designed an audio-vision training pack for course team academics (1981a), found that many students saw cassettes as a form of personal tutorial. "It is like having the course author in your own room", one student reported (1981b). Also, students have full control over the learning material. They can repeat the material several times, stop it when they want to, and leave it and come back to it at another time.

Audio-cassettes then are a very effective form of low-cost media for distance education.

AUDIO-GRAPHICS SYSTEMS

Audio-graphics systems basically combine "natural" sound, via the telephone or audio-cassettes, with computer-generated graphics, although in the future, the computer itself may generate the sound as well. The value of such a system for distance education has already been indicated by the application of CYCLOPS, a system designed by Open University academic research staff, to distance tutorials in the East Midlands region of the United Kingdom.

The heart of the CYCLOPS system was a microprocessor which generated video signals and then converted them to a coded audio-signal. The diagram below indicates the system provided to students in 15 local study centres in the East Midlands region between 1981 and 1983.

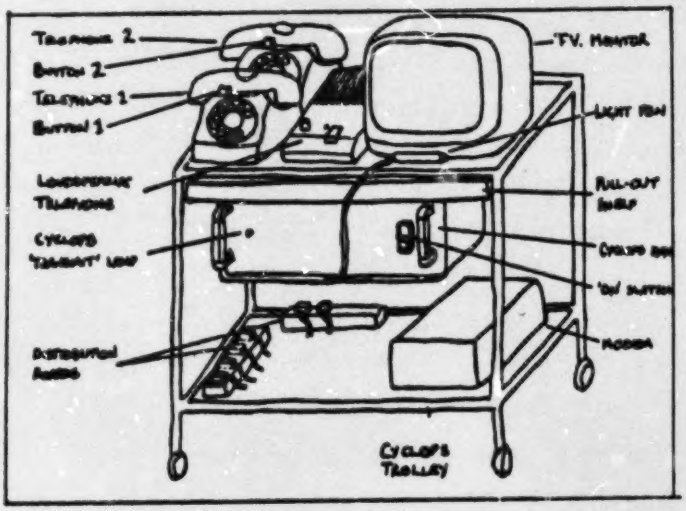

Figure 1

The system consisted of a trolley which contained two telephone lines, one for sound, one for the visual "data", a loudspeaker for the sound telephone line, a light pen which allows the student to draw or write on the TV screen, a standard TV monitor, the CYCLOPS box, and a standard British Telecom data modem for the data line.

Students were given a briefing at the beginning of their course on the use of CYCLOPS, and given a timetable of CYCLOPS tutorials and a list of local centres where CYCLOPS was located. The student would go along to the study centre, collect the key to the cupboard where the trolley wasstored, plug in the trolley to the power and telephone points, then

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wait to be called up. At the regional office in Nottingham was a standard telephone conferencing exchange operated by a member of the region's secretarial staff. The tutor may be in the regional office or any of the 15 study centres where a CYCLOPS trolley was located. Up to seven centres at any one time could be linked up. The tutor would present a tutorial, using the light pen or an electronic pad or pre-prepared diagrams stored on audio-cassettes. Students at each of the centres could also write on the screen or talk back or alter or erase what was on the screen. Whatever was said or put on the screen at one centre could be heard and seen by students at the other linked centres. Over the three years, tutors evolved a most effective style of tutorial to encourage full participation by students in remote centres. Over the three years, 22 courses received CYCLOPS tutorials, involving over 600 students, there being one tutorial every evening, Monday to Thursday, in one subject or another, during term time.

The project, which was mainly funded regarding technical equipment and line charges by British Telecom, has been extensively evaluated (see McConnell and Sharples, 1983). CYCLOPS was used primarily to provide tutorials on courses which otherwise would not have received tutorials, because the students were too thin on the ground to justify face-to-face tutorials. In other words, without CYCLOPS they would have received nothing except the basic course materials and correspondence tutoring. Students' reactions to the alternatives for tuition are interesting, as Table 1 indicates.

TABLE 1: STUDENT REACTIONS TO VARIOUS FORMS OF TUITION

Location	Form of tuition	Acceptable (% of students)*
Study centre	CYCLOPS (with other students)	76
Home	CYCLOPS (alone)	72
Study centre	Weekly face-to-face with 80 kms or more travel	63
Study centre	CYCLOPS (alone)	58
Home	Telephone tutorials (sound only)	53
Study centre	Saturday day-schools 2-3 times with 160 kms. or more travel	49

*% of students attending at least one CYCLOPS tutorial

from McConnell and Sharples, 1983.

It will be seen that more students preferred CYCLOPS to face-to-face tutorials, if the latter required extensive travel. Interestingly, students preferred a study centre location for CYCLOPS if it meant that other students would be present than CYCLOPS at home - an indication of students' nervousness about using "high-technology". The real alternative in the East Midlands region to CYCLOPS was the occasional Saturday day-school, which is now the most common form of tutorial support on most post-foundation courses at the Open University. It can be seen that this was acceptable to far fewer students than CYCLOPS tutorials.

Tutor reaction was also interesting. Tutors were given a free choice as to whether to use CYCLOPS or not. In the first year, four of the 22 tutors who started using CYCLOPS stopped (there were quite a lot of technical problems in the first year), but after that tutor reaction was generally very favourable. Certainly CYCLOPS tutorials needed greater preparation than face-to-face tutorials, and were very tiring, but tutors quickly learned to adapt their tutorial style to the requirements of teaching this way, and many of the tutors commented that they found it had improved their teaching.

Despite the success of CYCLOPS in the pilot trial, the Open University has not continued or extended the experiment, and there are some useful lessons to be learned from this. First of all, CYCLOPS did not replace an existing service but instead allowed a service to be provided that was not economically feasible to provide in any other way; nevertheless, it would add substantially to the presentation costs of a course, at a time when the Open University's budget was being reduced. Secondly, the CYCLOPS box was a hand-made prototype. The University secured an agreement with a manufacturing company (Aregon International Ltd.) who took the design, improved on it, and turned it into a piece of office equipment retailing at around £3500 a unit - far too expensive for a widespread application in the Open University. Thirdly, the system required students to attend local study centres, (as does face-to-face tutorials), but the University in general does not want to make students dependent on study centre attendance. Lastly, the CYCLOPS system required the use of two telephone lines for each tutorial, thus shifting the cost from students (travelling) to the Open University itself, which, if multiplied across the whole Open University system, would have led to a major increase in tutorial costs.

Nevertheless it is clear that a system similar to CYCLOPS will soon be available at low cost, as part of a standard microcomputer. (CYCLOPS facilities can be designed as a chip which can be added to standard microcomputers). The technology is here; there is just not a big enough demand for a system suitable for educational use (surely an area here for co-operation between distance education institutions).

VIDEO-CASSETTES

Another major development that has implications for distance education is the rapid growth of video-cassette ownership, and to some extent the spread of cable TV systems. However, the value of video-cassettes is a far more contentious issue than audio-cassettes. Television is not used extensively by most distance education institutions (the Open University is a clear exception), so it is really necessary to provide a general justification for using television in distance education.

There are four basic advantages that television can bring to distance education:

1. it can deliver learning materials to large numbers of people;

2. it can help recruit students to distance education courses;

3. it can provide unique learning resources for students, learning materials that could not be provided in other ways;

4. it can represent and organise knowledge in unique ways which can greatly help student learning.

The first two advantages are primarily functions of broadcast television. There are several reasons why broadcasting has not been used more extensively in distance education (see Bates, 1984a, for a full discussion), but a major reason has been the high cost of using national or regional broadcasting systems to reach relatively small numbers of students on distance education courses. However, the economics of video-cassette production and distribution makes the use of video-cassettes worth considering even by small distance education systems, if the educational benefits can be justified.

Television can provide distance education students with unique learning material which would be difficult if not impossible to get to them in any other way. At the Open University we have identified 18 different functions unique to television (see Bates, 1984a, for a full list). I will give four as examples:

1. to demonstrate experiments or experimental situations, particularly where equipment or phenomena to be observed are large, expensive, inaccessible or difficult to observe without special equipment, or where the experimental design is complex, or where the measurement of experimental behaviour is not easily reduced to a single scale or dimension (e.g. human or social behaviour) or where the experimental behaviour may be influenced by uncontrollable but observable variables; in the Open University context, it would be impossible to teach science to degree level without a good deal of the experimental work being handled through television; at the same time, the use of television allows experiments and experimental behaviour to be observed which would be difficult for even conventional university students to see.

2. to illustrate principles involving dynamic change or multiple variables interacting simultaneously over time; this covers a good deal of mathematics, economics, psychology and geography teaching, and can be demonstrated very effectively visually through graphics and computer animation.

3. to bring students primary resource material for analysis and interpretation; this is done by television going out into the world and bringing back material, particularly interviews or social behaviour, which can be used to illustrate or test concepts or general principles discussed or explained in the text.

4. to demonstrate processes which occur over space and time; television can be particularly useful for technology or social science courses, where processes may be complex or embedded in a rich context; television can highlight the essential features of the process.

As well though as bringing unique resource material to distant students, television has certain unique symbolic properties which can enhance the learning process. Salomon (1979) has drawn attention to three particular

roles for television in this respect:

1. it can provide real-world examples or illustrations of abstract concepts, thus providing a concrete reference point or mental image to which an idea can be attached.

2. television can supplant complex mental processes; in other words, television, through its unique use of graphics, language, movement and change over time, can provide students with a way of thinking about abstract ideas or concepts which the student would have difficulty in generating for himself.

3. television can provide students with specially constructed concrete models, images, or representations of abstract ideas.

Television can do this because it is particularly rich in the range of symbol systems it can accommodate: natural language, natural movement, text, moving pictures at a range of speeds, still pictures, music and other sounds, and full colour. In this sense it is a richer medium than any other, but its real power is its ability to act as a bridge between concreteness and abstraction through language. The commentary can make the link between the concrete visual images and the abstraction contained in language. This means though that to exploit fully the unique advantages of television, the visuals must be very carefully chosen, and linked to ideas via the commentary or graphics. This suggests therefore that it should be used very selectively for greatest impact.

Can video-cassettes though overcome the real difficulties and disadvantages of broadcast television? The main advantages of video-cassettes are as follows:

1. independence of transmission times; students can study the video material at the time when it is most appropriate.

2. production costs for video can be many times lower than for broadcasting; the cost of technical equipment suitable for non-broadcast material has dropped considerably, and using local video production facilities in educational institutions in particular means that the high costs due to the manning levels and support servicesrequired for broadcasting can be avoided;

production from a non-broadcast facility can be cheaper by a factor of 10.

3. in most developed countries, there is a surplus of non-broadcast video production capacity; this means that productions can be priced at marginal rates, that is, just the extra cost of making one extra programme, this way avoiding large overhead costs.

4. with video, you only pay for what you use, if production is commissioned externally; with an in-house production centre, it is desirable to keep the production centre working to capacity, even if this means making programmes that are not strictly necessary.

5. the most important point though about video-cassette production is that in general it is more effective instructionally than production for broadcasting.

This last point can be seen by comparing the control characteristics of broadcasts and cassettes:

TABLE 2: STUDENT CONTROL CHARACTERISTICS OF BROADCASTS AND CASSETTES

Broadcasts	Recordings
Dependent on transmission time	Available when needed
Single viewing	Repetition unlimited
Ephemeral	Permanent; available for revision
Cannot be interrupted	Can be stopped for reflection
Holistic	Segmented if necessary
One pace	Student controls pace, allowing for individual differences

These differences are discussed in some detail in Bates (1984a). However, from an analysis of these differences, certain design implications for video cassettes emerge:

1. the use of segments: only those aspects which require televisual presentation need be dealt with; segments may vary in length; the amount of video support can be spread unevenly throughout

the course, being concentrated just on those areas where the television support is most needed (as distinct from broadcasts, where, for transmission reasons, television tends to be spread evenly across a course).

2. Students should be given clear cues as to when to stop. Research by Durbridge (1984) has established that without clear cues, students tend to watch video continuously.

4. Clear guidance and selection of meaningful and useful activities is necessary. Students will only stop a cassette if they are convinced the activity they are being asked to do is meaningful and important.

5. Segments need to be clearly indexed with a number continuously on screen, so that each segment can be quickly found using the fast search facility now available on many cassette machines.

6. Student use of video-cassette machines in the home tends to be more restricted than the use of audio-cassettes. Unless there is more than one TV set and video machine in the house, conflict over use of the equipment with other members of the family is more likely than with audio-cassettes. Thus the frequent switching between cassette and text possible with audio is not so feasible with video (also it is not possible to read and watch the video at the same time). Thus video-cassette activities are likely to be more discrete than audio-cassette activities.

7. Clear decisions are needed about whether video -cassettes are aimed at individual use or group use. Durbridge (1983) has produced evidence to suggest that video-cassettes are more effective when linked to broadly based discussion points, rather than to points of detail, and broad-based discussion points are perhaps best handled in a group situation.

While then video-cassettes appear to have clear instructional advantages over broadcasts, they do need to be designed differently, and there do appear to be differences emerging between student use of video and audio-cassettes.

However, the main drawback to greater use of video-cassettes at the moment is the difficulty of student access. Many students do not have, nor are prepared to pay for, home ownership or access to a video replay machine. Table 3 below gives figures for the United Kingdom and the Federal Republic of Germany:

TABLE 3: STUDENT ACCESS TO VIDEO-CASSETTE MACHINES

	1983	1984	50% HOMES BY
Federal Republic of Germany	18%	25%	1988
United Kingdom: all households	30%	40%	1986
OU students at home	29%	?	1986
anywhere	53%	?	-

Source: Screen Digest, 1984 and Grundin, 1984.

Over half of Open University students claim to have convenient access to video-cassette machines, either at home or elsewhere (mainly work, e.g. teachers), although only 40% have access to VHS machines (the delivery system used by the Open University). Another 27% say that they are likely to get video-replay machines, if the University provided cassettes for their course. Lastly, BBC Audience Research Department claims that video-cassette availability is evenly distributed across all income groups, except the unemployed. Nevertheless, many students both in Britain and Germany will not have video-replay facilities for several years to come.

Consequently, the Open University began a video-cassette loan service in 1982, whereby students could borrow cassette recordings of broadcasts on selected courses, and either replay them at home, or take them to study centres, where the University placed video-cassette machines. The loaning of cassettes proved to be successful, over 20,000 being borrowed in the first year; the provision of machines in study centres was not though. Few students used the machines in study centres, which cost over £80,000 a year to provide, and at the end of the first year, 57 had been stolen! Consequently, althoughthe cassettes are still available for loan, the machines have been withdrawn from study centres. Most students either record off-air at home, or replay loaned cassettes at home, or do not use the system.

The video-cassette loan scheme has been used up to now primarily for playing back copies of programmes made as broadcasts. Recently, however, Open University course teams have started to design programmes in cassette format for physical distribution. We have found that if students return the cassettes at the end of the course, it is actually cheaper to send them cassettes than to pay the television transmission charges if there are less than 350 students on a course. There are now about 12 courses in preparation or in presentation using cassettes in this way. Durbridge (1984) though has found that such courses present real problems for many students, who claim that given the high course fees (now approaching £100 per course) they cannot afford to get video-cassette machines. It seems likely then that for the next few years at least, courses that require home use of video-cassettes will disadvantage a considerable proportion of students. At the same time, it must be remembered that even now, the Open University will get higher use of video-cassette materials than of broadcasts, because of the poor quality of the transmission times.

COMPUTER CONFERENCING

Computers will also have a major impact on distance teaching, but I suspect in a manner that will be a surprise to some people. There are several roles for computers, and I list them in what I consider will be their order of importance, at least over the next 10 years:

1. Administration, including registration, students' records, tutor and staff payments, etc. This is already a well-established role for computing in distance education and will continue to remain so. It does though also have implications for other areas of operation, particularly teaching. Despite the growth of micros and mini-computers, most distance education institutions are likely to have a mainframe computing system, if only to handle the large data base required. It may not be one machine, but the power available from a mainframe system will be useful to teaching and research, as well as to administration.

2. Communications, and particularly computer conferencing. Using a cheap, home computer and a word-processing package costing £50, a student can prepare an assignment or messages and queries for his tutor. The information is condensed and sent down the telephone line (via a modem) in a burst (to save line costs)

to be dumped on the distance teaching institution's main-frame computer. The tutor can call up all the assignments on his own home microcomputer, mark them and add comments or further work, and using a secure codeword, enter grades against the students' files. If the tutor wishes, students can access each other's assignments and comments. Students can comment back to the tutor or communicate with each other, either before or after preparing their assignments. "Conversations" via the key-board can take place in real time via the computer, or messages left by students or tutors to be collected when convenient. To do this, no computing skills are needed - just a list of codes to identify students and tutors, and commands to choose functions from a menu. The software which provides this facility can be bought "off-the-shelf" for £6,000, and can handle up to 200 simultaneous connections, depending on the mainframe capabilities. The Open Learning Institute in Canada is already using such a system on its Digital VAX computer for communications between headquarters staff and local tutors, and is considering using it for a creative writing course.

3. Course production. It is a short step from here to at least in the first instance creating courses through the computing system, then at a later date delivering them via computer. Again, Open Learning Institute is experimenting with "off-campus" academic consultants preparing drafts on their home micro and then down-loading the drafts on to the mainframe, from where OLI's editors call up the drafts and edit them on local terminals. The finally edited version is then made ready for printing, by the insertion of printing codes for layout, typeface, headings, etc. and then could go for direct printing via laser xerography, without the need for typesetting. Editing is again being done at OLI via an "off-the-shelf" word-processing package for the VAX mainframe (MASS-11).

4. Student assessment. Like administration, the use of computers for testing students is already well-established in distance education. Equally well known are its limitations. It seems better suited to the more quantitative subject areas, such as mathematics and science. There remain major problems though in getting academic staff to design high-quality and reliable

multiple choice questions.

5. It may come as a surprise to find computer assisted learning ranked as the least important use for computing in distance education, given the likely developments in artificial intelligence and knowledge-based systems. Nevertheless, I still believe that it will be many years before CAL becomes a major force in at least University-level distance education systems, for reasons outlined below.

The first problem is the need for authoring languages, which allow the teacher to construct the teaching in a way which suits the computer. While authoring languages will get more powerful and easier to use, many teachers do not want to spend the considerable time required to master the skills necessary to convert their teaching into a form suitable for the computing system. There is also some doubt about the capacity of home-based microcomputers to handle the quantity of data required for sophisticated computer-based learning. The alternative is high telephone costs while the student works from home on the mainframe.

Secondly, so far at least the range of teaching functions for which computer-assisted learning seems appropriate is quite limited. While these functions are often quite adequate for areas of industrial training, and for limited areas of University work, many areas of University teaching can at the moment be handled only with great difficulty in the restricted manner allowed by CAL.

Thirdly, there is the very high cost of developing suitable course material for computer-assisted learning, in its traditional form. Most experienced producers of CAL talk about a 100 to 1 ratio: 100 hours of development for one hour of teaching. This alone puts computer-assisted learning at the top end of media production costs.

Fourthly, there is the problem of equipment access and incompatibility of equipment. In 1982, 58% of Open University mathematics students had convenient access to a microcomputer. However, only 10% of the students had a machine using the same computing language! These problems can be overcome using a mainframe computer, but again it is a high-cost solution.

Lastly, a point brought out very clearly by the CYCLOPS experiment, most

micros lack the combination of voice and picture, and creating good graphics requires considerable computing skill from the teacher.

All these factors will inhibit the rapid spread of computer-assisted learning; on the other hand, systems such as CYCLOPS or computer-conferencing, which allow the user without computing skills easy access to and use of the facilities, are likely to be much more popular with teachers.

IMPLICATIONS FOR MEDIA SELECTION

These four examples highlight some of the main factors that have to be taken into consideration when selecting and using media:

1. Access: what technologies will be available in most students homes in the next ten years? What should the institution supply? What extra equipment is it reasonable to ask students to purchase or hire in order to study a course?

2. Costs: how much will it cost to produce? How much will it cost to deliver?

3. Student control. How much control does the technology give the student? How easy is it for the student to use? Does the technology get in the way of the student's learning?

4. Teacher control. How easy is the technology for the teacher to use? Will the teacher need training? Can he or she use it in the way they would like; or do they have to force the teaching into inappropriate styles of presentation? Will "professionals" intervene (e.g.programmers, producers).
5. Organisation. How easy is it to introduce the technology into the system? Can the administration handle the everyday running requirements? Who is responsible for maintenance of equipment, training, and queries?

6. Teacher time. How much time and effort must the teacher put into mastering the technology and designing materials for it?

7. Teaching objectives. What are the main teaching objectives - not so much in terms of content, but skills that are to be developed?

The last is a major problem. Space prevents a full discussion of this issue (see Bates, 1984a and Sparkes, 1984), but media seem to vary in their suitability for developing skills. For instance, what kind of response to the material is expected of the learner:

- aesthetic appreciation (in subjects such as dance, music, drama)

- increased awareness (as in courses with a more general target audience, e.g. current affairs, politics)

- comprehension and understanding: clearly, ephemeral media such as broadcasting are less suitable here

- developing skills, such as analysis, synthesis, application of knowledge, problem-solving: media are likely to vary in their ability to promote each of these skills

- task-oriented: discussion in groups or practical work.

When choosing media, teachers need to be very clear what their primary teaching objectives are.

It is quite clear that there are still a lot of problems in using new media in distance education. In some cases, the technology is still not ready in a form suitable for distance education, although it is only a matter of time - a couple of years or so - for some media, such as audio-graphics systems and microcomputers. Some technologies are still very difficult to use, both by teachers and students: computers remain an example. There is a lack of good exemplary material that can be used to guide course designers in the newer technologies. There is therefore a need to experiment and try new methods with new media. This will only happen though if teachers are willing to try new media. However, most distance education institutions give very little reward or support to those who want to try, in a time when most institutions are under increasing financial pressure. Nevertheless, some risk capital is essential.

Indeed, of all the barriers to innovation, I see the institution itself as being the greatest. Getting changes to established teaching systems through the committee system when a dozen "yes"s can be cancelled by one "no", the difficulty of releasing money from established expenditure areas for new areas of development, and above all the conservatism of administrative staff in implementing new practices, are all major barriers preventing new technologies being adopted. Distance education is still a relatively new educational initiative; it would be a pity if it ossified in the mass production models of the 1960's.

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